CALIFORNIA DEPARTMENT OF PESTICIDE REGULATION
PUBLIC REPORT 2006-1

Sulfentrazone

Tracking ID Number 211378N, 211330N, & 211331N

DESCRIPTION OF ACTION

PBI/Gordon Corporation submitted applications for registration in California of EH 1349 Herbicide, EPA Reg No. 2217-823, EH 1416 Herbicide, EPA Reg No. 2217-875, and EH 1418 Herbicide, EPA Reg No. 2217-876. These three products contain a combination of the new active ingredient, sulfentrazone, and three additional active ingredients found in currently registered pesticides: 2,4-D, dimethylamine salt, dicamba, dimethylamine salt, and MCPP-P, dimethylamine salt.

The three products were registered by the U.S. Environmental Protection Agency on the following dates: EH 1349 Herbicide registered September 29, 2003; EH 1416 Herbicide registered December 9, 2004; and EH 1418 Herbicide registered October 28, 2004.

BACKGROUND

Registrant:	PBI/Gordon Corporation
Common name:	Sulfentrazone
Chemical name:	N-[2,4-dichloro-5-[4-(difluoromethyl) 4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl]phenyl] methanesulfonamide
Brand names:	EH 1349 Herbicide, EH 1416 Herbicide, and EH 1418 Herbicide
Uses:	Control of broad leaf weeds in turfgrass
Pests controlled:	Wide range of broad leaf weeds
Type of registration:	Full/Conditional

The three products are water-based formulations containing the new active ingredient suflentrazone in combination with three other active ingredients in the following percentages:

Brand Name	% sulfentrazone	% 2,4-D	% Dicamba	% MCPP-P
EH 1349 Herbicide	0.43	18.00	1.68	6.49
EH 1416 Herbicide	0.18	7.57	0.71	2.73
EH 1418 Herbicide	0.008	0.342	0.032	0.123

The products are all labeled for control of a wide range of broad leaf weeds in turf grasses. EH 1349 Herbicide is labeled for use on turfgrass for institutional, commercial, and residential/domestic uses. However, the product is not approved for use on golf courses in California. EH 1416 Herbicide and EH 1418 Herbicide are labeled for use by homeowners on residential turfgrass. The combination of sulfentrazone with the three other active ingredients broadens the spectrum of weed control, provides a limited soil residual, and increases the speed of action.

The three products contain different concentrations of the four active ingredients as described above. EH 1349 Herbicide is labeled for institutional, commercial, and residential/domestic uses at a use rate of 5.0 to 6.0 pints of product per acre with a spray volume of 2.0 to 175 gallons per acre. The maximum number of broadcast applications per treatment site is two per year. EH 1416 Herbicide and EH 1418 Herbicide are labeled for use by homeowners. The recommended use dilution for EH 1416 Herbicide is 1.0 fl.oz. (2 Tbsp) in one (1.0) gallon of water to treat 500 square feet of lawn using a pressure sprayer. EH 1418 is a "ready-to-use" product intended for "spot" treatment. The product labels warn against use of the products in daytime temperatures above 85^{o}C.

SCIENTIFIC REVIEW

A. Chemistry

1. Product Chemistry: PBI/Gordon referenced and submitted product chemistry data to support the registrations of EH 1349 Herbicide, EH 1416 Herbicide, and EH 1418 Herbicide. Data on the technical material and the three formulated products are summarized in the following tables.

Table I. Physical and Chemical Properties Using Sulfentrazone Technical as the Test Substance

Properties	Values
Physical State	Tan solid w/faint sulfur odor
Density	1.66 g/mL
Solubility (water)	400 ppm
Vapor Pressure (25^{o})	8 x 10^{-10} mm Hg
pH (1% aqueous solution)	4.78
Storage Stability	3 years @ room temp

Table II. Physical and Chemical Properties Using EH 1349 Herbicide, EH 1416 Herbicide, and EH 1418 Herbicide as the Test Substance

Properties	EH 1349 Herbicide	EH 1416 Herbicide	EH 1418 Herbicide
Physical State	Liquid dark brown	Liquid dark brown	Liquid yellow brown
Density @ 20^{o}C	1.10 gm/mL	1.035 g/mL	1.003 gm/mL
Nominal Concentration %	2,4-D-DMA:18.0; MCPP-$_{p}$-DMA:6.49; Dicamba-DMA:1.68; Sulfentrazone: 0.43	2,4-D-DMA:7.57; MCPP-$_{p}$-DMA:2.73; Dicamba-DMA:0.71; Sulfentrazone: 0.18	2,4-D-DMA:0.342; MCPP-$_{p}$-DMA:0.123; Dicamba-DMA:0.032; Sulfentrazone: 0.008
pH 1% aqueous solution	6.3 @ 22.5^{o}C	6.43 @ 21^{o}C	7.15 @ 21.9^{o}C
Storage Stability	Stable for 1 year	None Submitted	None Submitted

Referenced and submitted product chemistry data support full registration of EH 1349 Herbicide and conditional registration of EH 1418 Herbicide and EH 1416 Herbicide. The conditional registrations are contingent upon the submission of a 12-month storage stability/corrosion study derived from the two products.

2. Residues in Food and Animal Feed: The products are not intended for use on food or feed. Therefore, residue data are not required.

3. Environmental Fate: The products are not intended for agricultural uses. Therefore, environmental fate data are not required.

B. Toxicology

PBI/Gordon Corporation submitted adequate toxicology studies to conduct complete toxicological evaluations for EH 1349 Herbicide, EH 1416 Herbicide, and EH 1418 Herbicide. DPR evaluated the submitted data to determine the potential for adverse health effects from exposure to these pesticides. The acute toxicity parameters for the three subject products are summarized in the following tables.

Table III. Acute Toxicity of EH 1349 Herbicide

Type of Study	Acute Toxicity Value	Acute Toxicity Category
Acute oral	2930 mg/kg	III
Acute dermal	>2000 mg/kg	III
Acute inhalation	>2.02 mg/l	IV
Primary eye irritation	N/A	I
Primary dermal irritation	N/A	IV
Dermal sensitization	N/A	Sensitizer
Signal Word		WARNING

Table IV. Acute Toxicity of EH 1416 Herbicide

Type of Study	Acute Toxicity Value	Acute Toxicity Category
Acute oral	<5000 mg/kg	III
Acute dermal	>5000 mg/kg	IV
Acute inhalation	>2.03 mg/l	IV
Primary eye irritation	N/A	IV
Primary dermal irritation	N/A	IV
Dermal sensitization	N/A	Not a sensitizer
Signal Word		CAUTION

Table V. Acute Toxicity of EH 1416 Herbicide and EH 1418 Herbicide

Type of Study	Acute Toxicity Value	Acute Toxicity Category
Acute oral	<5000 mg/kg	III
Acute dermal	>5000 mg/kg	IV
Acute inhalation	>2.03 mg/l	IV
Primary eye irritation	N/A	IV
Primary dermal irritation	N/A	IV
Dermal sensitization	N/A	Not a sensitizer
Signal Word		CAUTION

DPR found the acute toxicity studies for EH 1349 Herbicide, EH 1416 Herbicide, and EH 1418 Herbicide to be acceptable. The precautionary language on the proposed labels identifies the acute toxicity hazards noted in the studies. The three products exhibit low to moderate mammalian toxicity.

The labels for EH 1349 Herbicide, EH 1416 Herbicide, and EH 1418 Herbicide bear all required statements and warnings for safety to handlers and other persons who may be exposed to the pesticide. The product labels bear adequate First Aid Statements. The product labels for EH 1416 Herbicide and EH 1418 Herbicide require the user to wear a long-sleeved shirt, long paints, socks, shoes and rubber gloves. In addition to these requirements, the labeling for EH 1349 Herbicide requires the user to wear chemical-resistant gloves and eye protection.

DPR found submitted toxicology studies sufficient to satisfy the data requirements of the Birth Defects Prevention Act (Food and Agricultural Code Section 13121). Possible adverse effects were observed in a rat chronic toxicity study, a rat reproduction study, and a rat teratology study. DPR has not yet prioritized sulfentrazone for risk assessment. DPR prioritizes pesticide active ingredients for risk assessment based on the nature of the potential adverse health effects, number of potential adverse health effects, number of species affected, NOELs, potential for human exposure, use patterns, and similar factors. Based on these criteria, pesticides with the greatest potential for health problems are placed in high priority, with other chemicals being placed in moderate or low priority. The purpose of the risk assessment would be to appraise the potential for sulfentrazone to cause adverse health effects in humans if exposed to the pesticide as the result of a legal use. Further toxicity information is available in DPR's Summary of Toxicology Data for sulfentrazone, available on DPR public website at http://www.cdpr.ca.gov/docs/toxsums/pdfs/5923.pdf.

C. Fish & Wildlife

PBI/Gordon Corporation referenced fish and wildlife toxicity studies on file with DPR, including studies on bobwhite quail, Mallard duck, Bobwhite quail, bluegill sunfish, rainbow trout, Silverside minnow, Daphnia magna, honeybee, mysid shrimp, and oystershells. The

submitted data are adequate to characterize the toxicity to wildlife and aquatic animals from environmental exposure. Table VI summarizes the results of these studies.

Table VI. Summary of Fish & Wildlife Toxicity Values*

Bobwhite quail LD_{50}	>2250 mg/kg (NOEC 1350 mg/kg)
Mallard duck 8-day LC_{50}	5620 ppm (NOEC 5620 ppm)
Bobwhite quail LC_{50}	5620 ppm (NOEC 5620 ppm)
Bluegill sunfish LC_{50} (96 hrs)	93.8 ppm
Rainbow trout LC_{50} (96 hrs)	120 ppm
Silverside minnow LC_{50} (96 hrs)	114 ppm (NOEC 67.8 ppm)
Daphnia magna EC_{50} (48 hrs)	60.4 ppm
Honeybee LD_{50} (48 hrs)	25.1 µg/bee
Mysid shrimp LC_{50} (96 hrs)	1.07 ppm (NOEC 0.657 ppm)
Oystershell EC_{50} (96 hrs)	10.5 ppm (NOEC 10.5 ppm)

*The test substance used for the studies was BSN 2060 Technical.

**Acute toxicity values expressed as:

a. LD_{50}=lethal dose that will kill 50% of test population,

b. LC_{50}=lethal environmental concentration that will kill 50% of test population, and

c. EC_{50}=concentration that caused some effect that can lead to death

The data indicate sulfentrazone is relatively non-toxic to birds, slightly toxic to fish, and moderately to highly toxic to saltwater aquatic invertebrates. Sulfentrazone is slightly to moderately toxic to oyster shell and slightly toxic to honeybees. The label warns users that the product is toxic to aquatic invertebrates and prohibits direct application to water or areas where surface water is present. The label use instructions and environmental hazards statements for EH 1349 Herbicide, EH 1416 Herbicide, and EH 1418 Herbicide mitigate the potential environmental hazards associated with use of the three products when used in accordance with label directions.

D. Efficacy & Phytoxicity

Sulfentrazone is in the aryl triazolinone family and inhibits protoporphyrinogen oxidase (protox), a pivotal enzyme in chlorophyll production. Without this enzyme, a build-up of peroxide-like compounds occurs, causing the plant cell membrane to rupture. Sulfentrazone is primarily taken up by the roots of treated plants. Plants emerging from treated soil turn necrotic and die after exposure to light. Foliar contact causes rapid desiccation and necrosis of exposed plant tissue. Referenced efficacy data support the label claims for control of broad leaf weeds in turfgrass. There were no phytotoxicity concerns at the label recommended use rates. The products are not intended for use on bentgrass greens, carpetgrass, dichondra, legumes or lawns containing desirable clovers.

ALTERNATIVES

The combination sulfentrazone with the three other active ingredients in these products broadens the spectrum of broad leaf weeds controlled, and most important it increases the speed of

herbicidal action and provides a limited soil residual for control of later germinating weed species, than any one of the active ingredients by itself. Sulfentrazone is needed to help manage herbicide resistant weeds, including triazine resistant lambsquarters and pigweed and resistant kochia.

CONCLUSION

DPR evaluated the product labels and scientific data submitted to support the registrations of EH 1349 Herbicide, EH 1416 Herbicide, and EH 1418 Herbicide. The labeling and data were found acceptable to support full registration of EH 1349 Herbicide and conditional registration of EH 1418 Herbicide and EH 1416 Herbicide. The acute health risks to human from exposure to sulfentrazone are minimal due to its low mammalian toxicity. The precautionary and first aid statements on the product labels and the other recommended protective measures mitigate potential health risks to persons who may be exposed to these pesticides. If a risk assessment conducted by DPR determines that exposure to sulfentrazone may result in unacceptable margins of exposure, further restrictions will be placed on the use of sulfentrazone at that time. Submitted data indicate that no significant adverse environmental impacts are expected to occur from the use of EH 1349 Herbicide, EH 1416 Herbicide, and EH 1418 Herbicide and that when used in accordance with label directions, the products will be effective for the intended use.

Conditional registration is recommended for EH 1416 Herbicide and EH 1418 Herbicide contingent upon the submission of 12-month storage stability/corrosion study derived from the two products and submitted within 18 months.